

AMENDMENTS TO THE CLAIMS

Claims 1-40 were pending at the time of the Office Action.

Claims 1-9, 11-15, 17-24, 26, 28-30, and 33-40 are amended.

Claims 1-40 remain pending.

1. (Currently amended) A computer-implemented method comprising:

determining a bid term, the bid term associated with multi-type data objects;

identifying relationships ~~between~~ among the multi-type data objects, wherein the multi-type data objects comprise at least one object of a first type and at least one object of a second type different from the first type;

iteratively clustering the multi-type data objects ~~in view of respective ones of~~ by at least one of the ~~identified~~ relationships to generate reinforced clusters; and

utilizing, by a search term suggestion ~~component~~ module, the reinforced clusters to respond to a search query ~~the bid term~~ from a user with search terms relevant to the ~~search query~~ bid term.

2. (Currently amended) The method of claim 1, wherein the relationships comprise inter-layer relationships including at least one ~~or more of~~ content related information, user interest in an associated topic, and user interest in an associated Web page.

3. (Currently amended) The method of claim 1, wherein the relationships comprise intra-layer relationships including at least one or more of query refinement(s), recommended Web page(s), and relationship(s) between respective users.

4. (Currently amended) The method of claim 1, wherein each of the multi-type data objects are related to ~~one or more~~ at least one of a search query data object type, a selected Web page type, and a user information type.

5. (Currently amended) The method of claim 1, wherein ~~respective ones of the relationships~~ the at least one of the identified relationships are weighted to indicate importance to associated objects of the multi-type data objects.

6. (Currently amended) The method of claim 1, wherein the identifying and the iteratively clustering are performed for search term ~~suggestion~~ suggestions.

7. (Currently amended) The method of claim 1, wherein the iteratively clustering ~~further comprises~~ propagating clustering results of a first iteration to all related data objects of the multi-type data objects, at least two of the related data objects being of heterogeneous data type, the propagating being used to enhance clustering of respective ones of the multi-type data objects in a second iteration of reinforced clustering operations.

8. (Currently amended) The method of claim 1, wherein the iteratively clustering ~~further~~ comprises determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one or more of inter-object and intra-object content similarity and similarities between respective ones of the relationships ~~the at least one of the identified relationships~~.

9. (Currently amended) The method of claim 1, wherein the iteratively clustering ~~further~~ comprises merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

10. (Previously presented) The method of claim 1, wherein the method further comprises mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types.

11. (Currently amended) The method of claim 10, wherein the mutually reinforcing the importance of individual ones of the multi-type data objects within an object type and between different object types is based on the following:

$$\begin{cases} a(X) = \beta L_X^T h(X) + (1 - \beta) L_{XY} i(Y) \\ h(X) = \beta L_X a(X) + (1 - \beta) L_{XY} i(Y) \\ i(X) = a(X) + h(X) \\ a(Y) = \gamma L_Y^T h(Y) + (1 - \gamma) L_{YX} i(X) \\ h(Y) = \gamma L_Y a(Y) + (1 - \gamma) L_{YX} i(X) \\ i(Y) = a(Y) + h(Y) \end{cases}$$

wherein $X = \{x_1, x_2, \dots, x_m\}$ and $Y = \{y_1, y_2, \dots, y_n\}$ represent respective object sets of heterogeneous object type with relationships R_X , R_Y , R_{XY} and R_{YX} if directionality is considered, L_X and L_Y represent adjacent matrixes of links identifying relationships within set X and Y respectively, L_{XY} and L_{YX} represent adjacent matrixes of links identifying relationships from objects in X to objects in Y , $a(X)$ and $h(X)$ are an *authority* score and *hub* score of nodes within X respectively, $a(Y)$ and $h(Y)$ respectively represent *authority* and *hub* scores of nodes in Y , $i(X)$ and $i(Y)$ respectively represent an *importance* of the nodes in X and Y , and β and γ are weight parameters to adjust influence of links derived from different relationships.

12. (Currently amended) The method of claim 1, wherein the utilizing the reinforced clusters ~~further~~ comprises:

responsive to receiving a ~~the~~ bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to comparing, identifying one or more search term suggestions; and communicating the search term suggestions to the user.

13. (Currently amended) A computing device comprising:

a processor; and

a memory coupled to the processor, the memory comprising computer-program instructions executable by the processor for:

identifying relationships ~~between~~ among multi-type data objects, wherein the multi-type data objects comprise at least one object of a first type and at least one object of a second type different from the first type;

iteratively clustering the multi-type data objects ~~in view of respective ones of~~ by at least one of the relationships to generate reinforced clusters, each relationship of the relationships being weighted to indicate an importance to associated objects of the multi-type data objects; and

utilizing, by a search term suggestion ~~component~~ module, the reinforced clusters to respond to a ~~search query~~ bid term from a user with search terms relevant to the ~~search query~~ bid term.

14. (Currently amended) The computing device of claim 13, wherein the relationships comprise inter-layer relationships including at least one ~~or more of~~ content related information, user interest in an associated topic, and user interest in an associated Web page.

15. (Currently amended) The computing device of claim 13, wherein the relationships comprise intra-layer relationships including ~~one or more~~ at least one of query refinement(s), recommended Web page(s), and relationship(s) between respective users.

16. (Previously presented) The computing device of claim 13, wherein identifying and iteratively clustering are performed for search term suggestion.

17. (Currently amended) The computing device of claim 13, wherein the computer-program instructions for iteratively clustering ~~further~~ comprise instructions for aggregating data object relationships to related ones of the multi-type data objects based on content of the reinforced clusters.

18. (Currently amended) The computing device of claim 13, wherein the instructions for the iteratively clustering ~~further~~ comprise instructions for determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one ~~or more~~ of inter-object and intra-object content similarity and similarities between ~~respective ones of the relationships~~ the at least one of the identified relationships.

19. (Currently amended) The computing device of claim 13, wherein the instructions for the iteratively clustering ~~further~~ comprise instructions for merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

20. (Currently amended) The computing device of claim 13, wherein the instructions for the iteratively clustering ~~further~~ comprise instructions for iteratively clustering until all object types represented by the multi-type data objects converge.

21. (Currently amended) The computing device of claim 13, wherein the utilizing the reinforced clusters ~~further~~ comprises:

responsive to receiving a the bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to comparing, identifying one or more search term suggestions; and
communicating the search term suggestions to the user.

22. (Currently amended) A tangible computer-readable data storage medium comprising computer-executable instructions executable by a processor for:

identifying ~~one or more~~ at least one of intra-layer and inter-layer relationships ~~between among~~ multi-type data objects, wherein the multi-type data objects comprise at least one object of a first type and at least one object of a second type different from the first type;

iteratively clustering the multi-type data objects ~~in view of respective ones of~~ by at least one of the relationships to generate reinforced clusters; and

utilizing, by a search term suggestion ~~component module~~, the reinforced clusters to respond to a search query bid term from a user with terms relevant to the search query bid term.

23. (Currently amended) The computer-readable medium of claim 22, wherein the inter-layer relationships comprise at least one ~~or more of~~ content related information, user interest in an associated topic, and user interest in an associated Web page.

24. (Currently amended) The computer-readable medium of ~~recited in~~ claim 22, wherein the intra-layer relationships comprise ~~one or more~~ at least one of query refinement(s), recommended Web page(s), and relationship(s) between respective users.

25. (Previously presented) The computer-readable medium of claim 22, wherein each of the multi-type data objects are related to at least one of a search query data object type, a selected Web page type, and a user information type.

26. (Currently amended) The computer-readable medium of claim 22, wherein ~~respective ones of the relationships~~ the at least one of the identified relationships are weighted to indicate an importance to associated objects of the multi-type data objects.

27. (Previously presented) The computer-readable medium of claim 22, wherein identifying and iteratively clustering are performed for search term suggestion.

28. (Currently amended) The computer-readable medium of claim 22, wherein the iteratively clustering ~~further~~ comprises propagating clustering results of a first iteration to all related data objects of the multi-type data objects, at least two of the related data objects being of heterogeneous data type, the propagating being used to enhance clustering of respective ones of the multi-type data objects in a second iteration of reinforced clustering operations.

29. (Currently amended) The computer-readable medium of claim 22, wherein the iteratively clustering ~~further~~ comprises determining a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one of object content similarity and similarities between ~~respective ones of the relationships~~ the at least one of the identified relationships.

30. (Currently amended) The computer-readable medium of claim 22, wherein the iteratively clustering ~~further~~ comprises merging related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

31. (Previously presented) The computer-readable medium of claim 22, wherein the instructions further comprise instructions for mutually reinforcing an importance of individual ones of the multi-type data objects within an object type and between different object types.

32. (Previously presented) The computer-readable medium of claim 31, wherein mutually reinforcing the importance of individual ones of the multi-type data objects within an object type and between different object types is based on the following:

$$\left\{ \begin{array}{l} a(X) = \beta L_X^T h(X) + (1 - \beta) L_{XY} i(Y) \\ h(X) = \beta L_X a(X) + (1 - \beta) L_{XY} i(Y) \\ i(X) = a(X) + h(X) \\ a(Y) = \gamma L_Y^T h(Y) + (1 - \gamma) L_{YX} i(X) \\ h(Y) = \gamma L_Y a(Y) + (1 - \gamma) L_{YX} i(X) \\ i(Y) = a(Y) + h(Y) \end{array} \right.$$

wherein $X = \{x_1, x_2, \dots, x_m\}$ and $Y = \{y_1, y_2, \dots, y_n\}$ represent respective object sets of heterogeneous object type with relationships R_X , R_Y , R_{XY} and R_{YX} if directionality is considered, L_X and L_Y represent adjacent matrixes of links identifying relationships within set X and Y respectively, L_{XY} and L_{YX} represent adjacent matrixes of links identifying relationships from objects in X to objects in Y , $a(X)$ and $h(X)$ are an *authority* score and *hub* score of nodes within X respectively, $a(Y)$ and $h(Y)$ respectively represent *authority* and *hub* scores of nodes in Y , $i(X)$ and $i(Y)$ respectively represent an *importance* of the nodes in X and Y , and β and γ are weight parameters to adjust influence of links derived from different relationships.

33. (Currently amended) The computer-readable medium of claim 22, wherein utilizing the reinforced clusters ~~further comprises for:~~

responsive to receiving ~~a~~the bid term from a user, comparing the bid term with a feature space of objects in the reinforced clusters;

responsive to the comparing, identifying one or more search term suggestions; and communicating the search term suggestions to the user.

34. (Currently amended) A ~~computing device system~~ comprising:

means for identifying ~~means to identify~~ relationships between multi-type data objects, wherein the multi-type data objects comprise at least one object of a first type and at least one object of a second type different from the first type;

means for ~~iterative clustering means to iteratively clustering~~ the multi-type data objects ~~in view of respective ones of~~ by at least one of the relationships to generate reinforced clusters; and

means for utilizing ~~means to use~~ the reinforced clusters to respond to a search ~~query~~ bid term from a user with search terms relevant to the ~~search query~~ bid term.

35. (Currently amended) The ~~computing device system~~ of claim 34, wherein ~~the computing device further comprises~~ comprising means for weighting ~~means to weight~~ ~~respective ones of the relationships~~ the at least one of the identified relationships to indicate an importance to associated objects of the multi-type data objects.

36. (Currently amended) The ~~computing device system~~ of claim 34, wherein the ~~computing device further comprises comprising means for determining means to locate~~ a search term suggestion from the reinforced clusters responsive to receipt of a bid term, the search term suggestion substantially matching or being related to at least one or more of the multi-type data objects.

37. (Currently amended) The ~~computing device system~~ of claim 34, wherein the means for iteratively clustering means further comprise means for aggregating means to propagate data object relationships to related ones of the multi-type data objects based on content of the reinforced clusters.

38. (Currently amended) The ~~computing device system~~ of claim 34, wherein the means for iteratively clustering means further comprise means for determining means to determine a similarity between individual ones of the multi-type data objects, the similarity being a function of at least one of object content similarity and similarities between ~~respective ones of the relationships~~ the at least one of the identified relationships.

39. (Currently amended) The ~~computing device system~~ of claim 34, wherein the means for iteratively clustering means further comprise means for merging means to combine related ones of the multi-type data objects to reduce feature space dimensionality of the related ones.

40. (Currently amended) The ~~computing device system~~ of claim 34, wherein the means for utilizing means further comprises:

~~comparing~~ means, responsive to receiving a term from a user, ~~to compare for~~ comparing the term with a feature space of objects in the reinforced clusters; and

responsive to comparing, means for identifying ~~means to identify~~ one or more search term suggestions.